Mathematics Grade 7

Mathematics is used as a means to communicate about quantities, logical relationships, and unknowns. Such a simplistic statement may make students who are not planning to go to college ask why mathematics is necessary for them. While the ability to do computation is important, it is the skills of problem finding and problem solving along with developing abstract thinking, symbolic representation and interpretation, logical arguments, and objective reasoning that allow us to function effectively and understand our world.

Mathematics is the one area of coursework in the school curriculum where students are taught these skills and where answers cannot be obtained just by common sense and guessing. Even without an ever-increasing reliance on technology, mathematical skills meet needs for practical everyday life, intelligent citizenship, and future employment. A study by Arizona State University indicated that students who opt out of advanced levels of mathematics and science may now eliminate up to 75% of career opportunities from which to choose[†]. Algebra has been called the academic passport for passage into virtually every facet of the job market. Employers want their employees to be able to set up problems, estimate solutions, identify how accurate solutions need to be, work with other people to reach goals, know the many different types of mathematics that exist, and determine which one is needed in a particular situation. It is clear that the mathematical literacy of the twentieth century will **not** be sufficient for the twenty-first century.

[†]*ASU Research* Fall 1998, p. 41

About the Test

The AIMS DPA Mathematics test contains approximately 80 multiple-choice questions. Fifty-five of the items are AIMS questions. Fifteen items are *TerraNova* and AIMS questions, and 10 items are *TerraNova* questions. Calculators are not allowed; however, the calculations required can be readily handled with pencil and paper. The questions will emphasize conceptual understanding, process, and problem-solving skills rather than just computation skills.

Hints for Taking AIMS Mathematics

- Remember, this is not a timed test. Take your time and do your best work.

- Check to see if your answer is reasonable.

- Since calculators are not allowed on this test, double-check your work!

Sample Questions for Mathematics

What To Expect From This Section

This AIMS DPA Student Guide for Mathematics provides examples of the format and types of questions that will appear on AIMS DPA Mathematics. An attempt has been made to provide a sampling of the types of questions that might be asked; however, not every concept in each strand has a corresponding sample question in this guide. An answer key for all mathematics sample questions is provided in the appendices. Additionally, you will find an AIMS DPA Mathematics Reference Sheet in the appendices. The reference sheet in the actual AIMS Mathematics test will be revised to reflect the formulas and other information that will be included on the test.

Strand 1: Number Sense and Operations

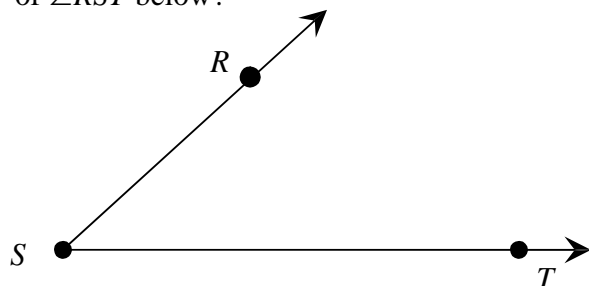**General concepts you should know:**
- Real number system and its various subsystems (natural, whole, integers, and rational).
- Operations with integers.
- Scientific notation.
- Estimation strategies.

1 Which of the following best represents the point *P* on the number line below?

    A −10

    B −8

    C   8

    D 10

2 In which set of integers are the numbers ordered from least to greatest?

    A {-7, -2, 5, -3, 8}

    B {8, 5, -2, -3, -7}

    C {-7, -3, -2, 5, 8}

    D {8, -2, -3, 5, -7}

3 A taxi charges $2 per trip plus $0.30 per mile. Melissa took a 32-mile taxi ride to the airport. What should be the total charge for the taxi ride?

    A $9.60

    B $11.60

    C $19.20

    D $23.20

4 What is 273.83 written in scientific notation?

    A 2.7383×10^2

    B 2.7383×10^3

    C 27.383×10^2

    D 27.383×10^3

5 Which of the following is closest to the measure of ∠RST below?

A   20°

B   45°

C   85°

D   100°

Strand 2: Data Analysis, Probability, and Discrete Math

General concepts you should know:
- Graphs (histograms, line graphs, circle graphs, frequency charts, stem-and-leaf plots, and scatter plots).
- Measures of central tendency, variability and correlation (mean, median, mode, and range).
- Pattern prediction.
- Probability.
- Probable outcomes of events.
- Systematic listing and counting; outcomes sets.
- Use of combinations vs. permutations.

6   Aftyn wants to build a new house. Which of these survey questions would be **least** helpful in deciding where to build the house?

A   Is the soil in the area firm enough to support a house?

B   Does the area have a dependable water supply?

C   Is a source of electricity available in the area?

D   Are people allowed to have pets in the area?

7   The number of customers entering Marcel's jewelry store each hour during the weekend are shown in the table below.

Number of Customers

Tens	Ones
0	6, 7
1	2, 2, 2, 5, 6, 8, 9
2	1, 1, 3, 5, 8
3	0, 1, 1, 3

Key 1│3 means 13

What is the median number of customers during the weekend?

A   9

B   12

C   20

D   27

8 Tom and Antwan conducted a probability experiment using different colored marbles of the same size. They entered the results of the experiment in the table below.

Results

Tom	Red	Blue	Red	Blue	Blue	Green	Blue	Red	Blue	Green
Antwan	Blue	Blue	Red	Green	Green	Red	Blue	Red	Green	Blue

Which of these is a true statement about the results?

A Both chose three green marbles.

B Both chose five blue marbles.

C Both chose three red marbles.

D Both chose four green marbles.

9 An obstacle course is designed so that the obstacles between each checkpoint have different difficulty ratings. The difficulty rating for each obstacle is marked on each edge of the vertex edge graph below.
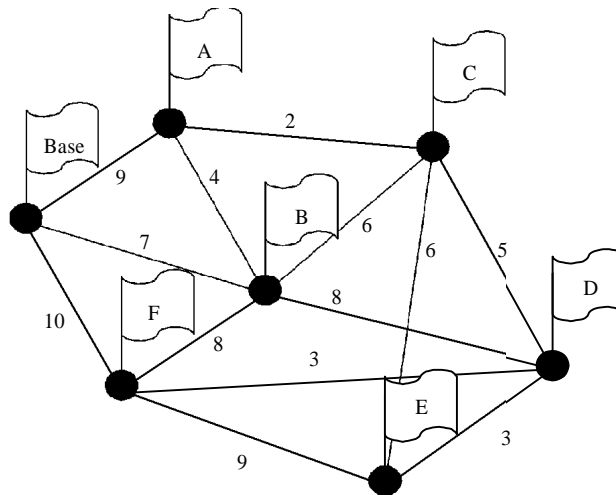
Which of the following is the least difficult (lowest total rating points) route for a runner to collect all 6 flags and return to base?

A Base, A, B, C, D, E, F, Base

B Base, A, C, B, D, E, F, Base

C Base, B, A, C, D, E, F, Base

D Base, B, A, C, E, D, F, Base

Strand 3: Patterns, Algebra, and Functions

General concepts you should know:
- Identifying and extending patterns.
- Graphing, evaluating, simplifying, and solving simple linear equations.
- The slope of a line and what it represents.

10 Which expression describes the rule used in the input/output model below?

Input (x)	6	12	21	27	33	36
Output (y)	7	9	12	14	16	17

A $x \div 3 + 5$

B $x \div 6 + 6$

C $x \cdot 3 - 11$

D $x \cdot 6 - 29$

11 What is the value of the expression below when $x = 3$ and $y = -5$?

$$-3xy + y^2$$

A -70

B -20

C 20

D 70

12 Sierra drew a pattern using two rings and re-arranged it in 3 steps using a specific rule, as shown below.
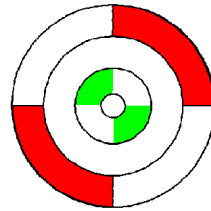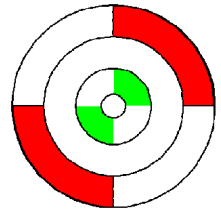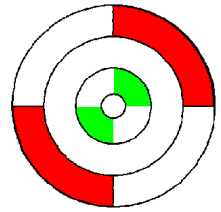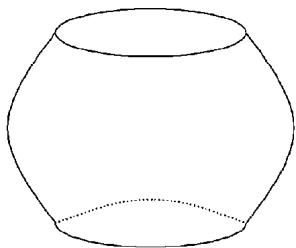

Original Pattern   Step 1
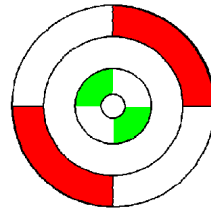
Step 2   Step 3

What is the rule Sierra used to change her pattern?

A Rotate the outer ring.

B Rotate the inner ring.

C Rotate the inner ring then rotate the outer ring.

D Rotate the inner and outer rings together.

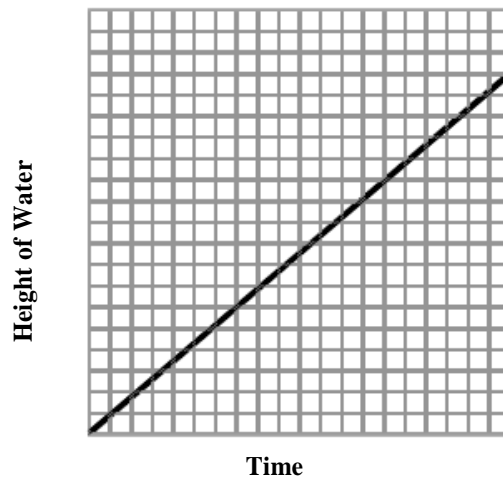**13** Jill filled the vase below, from bottom to top, with water at a constant rate.

Which of the following best represents the change in the height of the water level as she filled the vase?
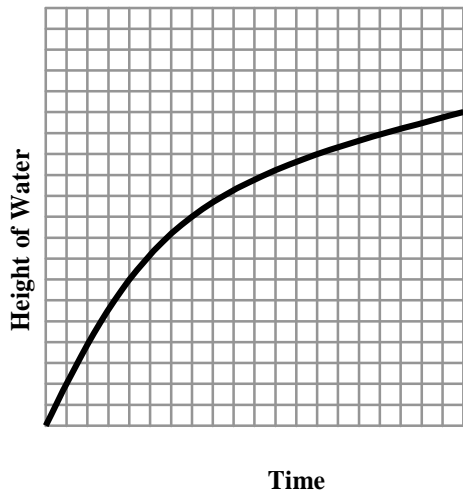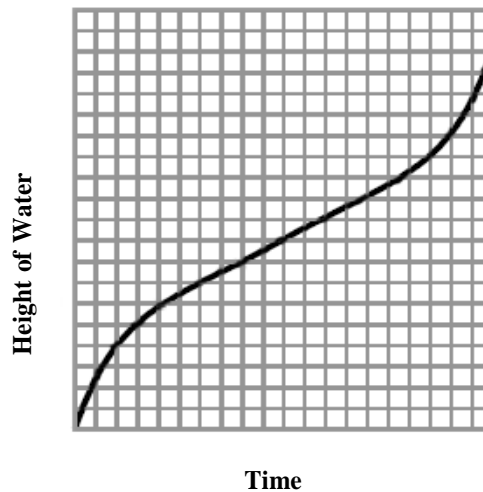
A

Height of Water

Time

C

Height of Water

Time

B

Height of Water

Time

D

Height of Water

Time
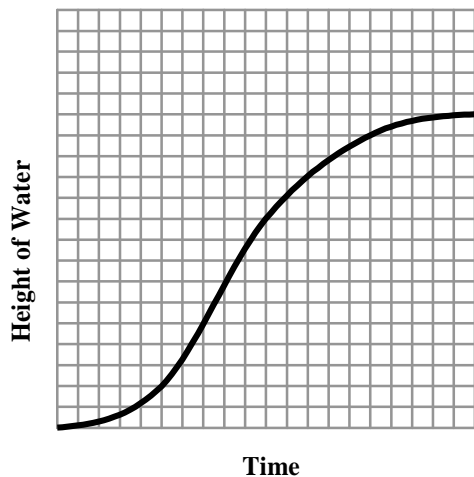
Strand 4: Geometry and Measurement

General concepts you should know:
- Geometric relationships (parallelism, perpendicularity, congruency).
- Angle characteristics (complementary, supplementary, and congruent).
- Circle characteristics (arcs, chords and inscribed angles).
- Identification of prisms, pyramids, cones, cylinders, and spheres.
- Transformations (reflections, rotations, dilations, translations; symmetry).
- Appropriate units of measure, applications of techniques and formulas.
- Perimeter, area, volume; measuring line segments, lines, angles, 2-D and 3-D figures.

9 cm

11 cm

7 cm

9 cm   5 cm
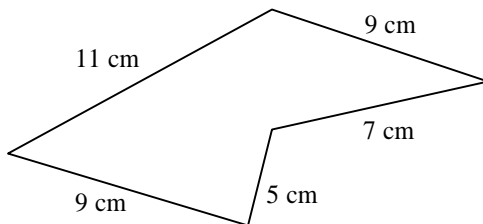
14 What is the perimeter of the figure above?

A   23 cm

B   41 cm

C   99 cm

D   108 cm

15 Points *B*, *C*, and *D* lie on circle *F*.
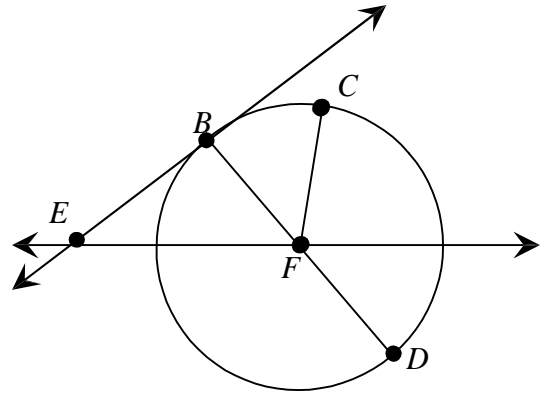
Which two points are endpoints of a radius of circle F?

A   *B* and *F*

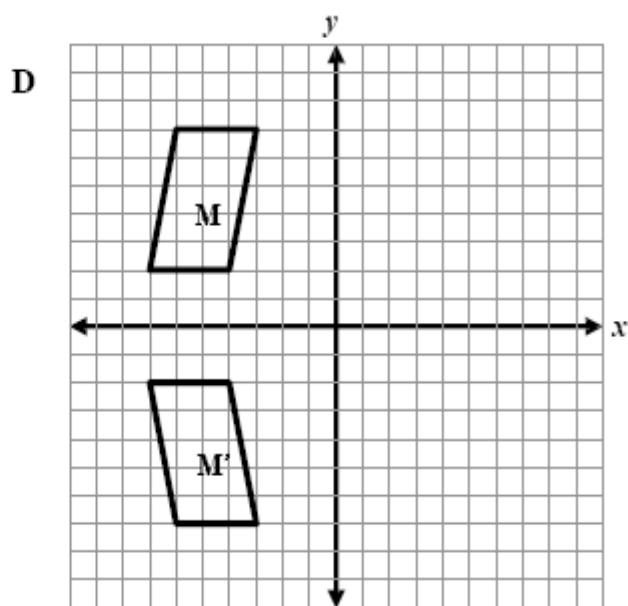**B**   *B* and *D*

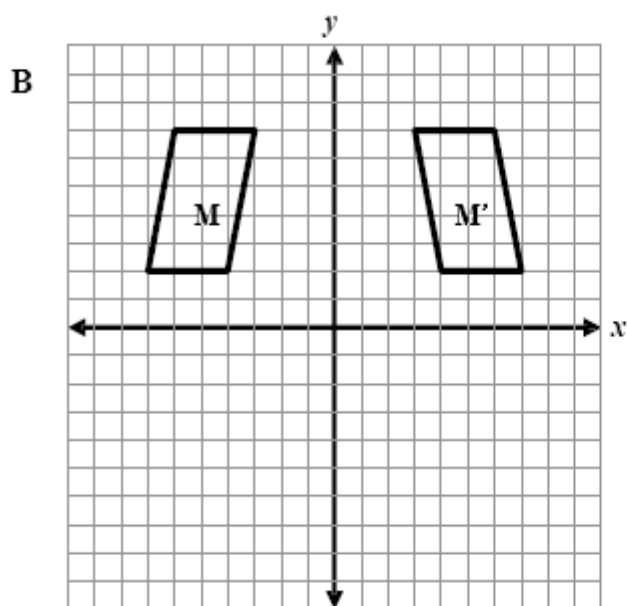**C**   *E* and *F*
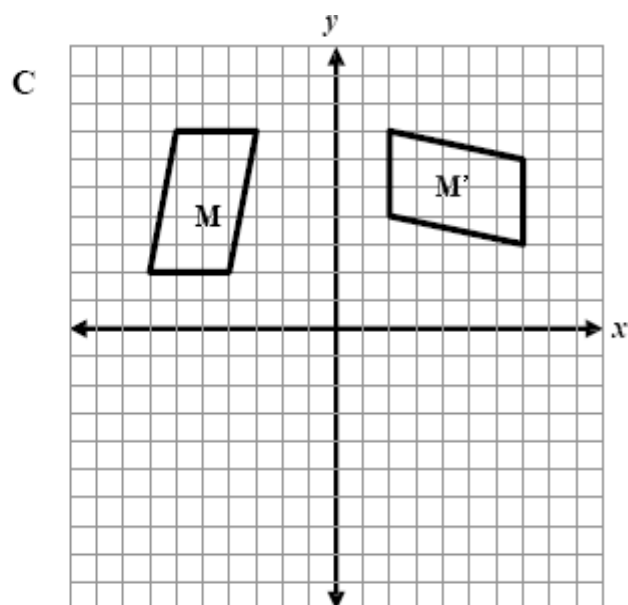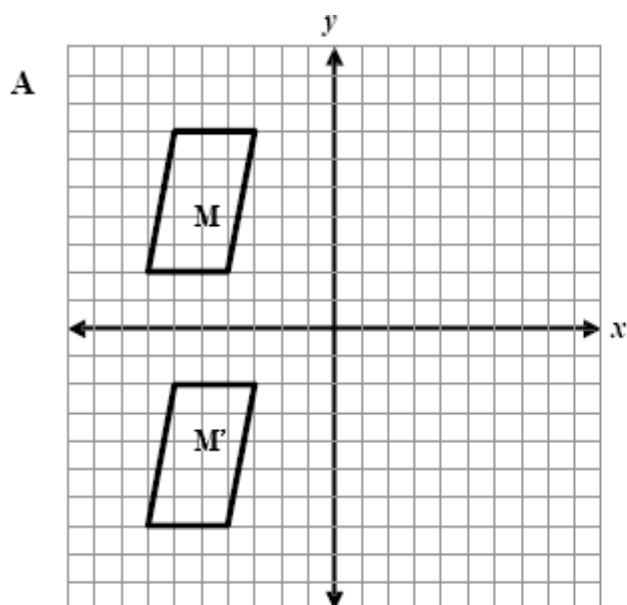
D   *E* and *B*

16 Three of the vertices of a partially drawn parallelogram are shown in the graph below.

(3, 3)

(1, 2)

(7, 2)
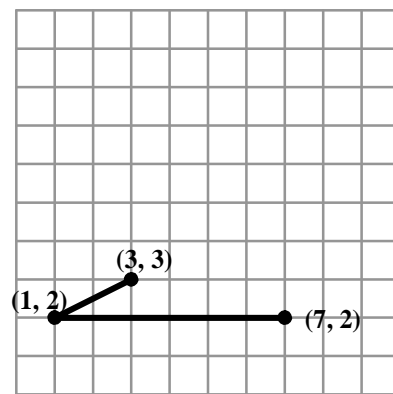
What are the coordinates of the missing vertex?

A   (8, 4)

B   (4, 8)

C   (9, 3)

D   (3, 9)

17 Which of the following is a reflection of figure **M** over the *x*-axis to form **M′**?

A

C

B

D

Strand 5: Structure and Logic

General concepts you should know:
- Inductive and deductive reasoning.
- Validity of arguments.

18 Dena, Bobbi, and Tamayra are in the same class. Their last names are Wilson, Jones, and Malkier, in no particular order. Each has a different amount of money for lunch.

- Dena has more money than either Bobbi or Wilson.
- Tamayra has more money than Jones, but less than Malkier.

What are the full names of the girls in order of the amount of money they have, from least to greatest?

A Bobbi Jones, Tamayra Wilson, Dena Malkier

B Dena Malkier, Tamayra Wilson, Bobbi Jones

C Dena Malkier, Tamayra Jones, Bobbi Wilson

D Bobbi Wilson, Tamayra Jones, Dena Malkier

AIMS DPA Mathematics Reference Sheet

PLANE FIGURES: PERIMETERS AND AREAS

Name	Notation	Perimeter (P) Circumference (C)	Area (A)
Triangle	a, b, c = sides h = height	$P = a + b + c$	$A = \dfrac{1}{2}\,bh$ or $A = \dfrac{bh}{2}$
Rectangle	b = base h = height	$P = 2(h + b)$	$A = bh$
Circle	r = radius d = diameter	$C = \pi d$ or $C = 2\pi r$	$A = \pi r^2$
Parallelogram	a, b = sides h = height	$P = 2(a + b)$	$A = bh$
Trapezoid	a, b, c, d = sides B_1 = long base B_2 = short base h = height	$P = a + b + c + d$	$A = \dfrac{(B_1 + B_2)h}{2}$
			Use 3.14 or $\dfrac{22}{7}$ for π

GEOMETRIC SOLIDS: VOLUMES

Name	Notation	Volume (V)
Rectangular Prism	l = length w = width h = height	$V = lwh$
Rectangular Pyramid	B = area of the base h = height	$V = \dfrac{1}{3}\,Bh$ or $V = \dfrac{Bh}{3}$
Right Cylinder	r = radius h = height	$V = \pi r^2 h$
Right Cone	r = radius h = height	$V = \dfrac{1}{3}\pi r^2 h$ or $V = \dfrac{\pi r^2 h}{3}$
Sphere	r = radius	$V = \dfrac{4}{3}\pi r^3$

GEOMETRIC SOLIDS: SURFACE AREAS

Name	Notation	Surface Area (SA)
Rectangular Prism	l = length w = width h = height	$SA = 2lw + 2lh + 2wh$
Right Cylinder	r = radius h = height	$SA = 2(\pi r^2 + \pi rh)$

Scoring Key

<u>Mathematics Key</u>

Question #1: B
Question #2: C
Question #3: B
Question #4: A
Question #5: B
Question #6: D
Question #7: C
Question #8: C
Question #9: D
Question #10: A
Question #11: D
Question #12: B
Question #13: D
Question #14: B
Question #15: A
Question #16: C
Question #17: D
Question #18: A